ThP 225

Versatile applications of MS imaging using a bench-top linear MALDI-TOFMS

Yuzo Yamazaki[1], Shuuichi Nakaya[1], Catherine Rawlins[2], Simona Salivo[2]
1:Shimadzu Corporation, Kyoto, Japan; 2: Kratos Analytical, Manchester, UK

1. Overview

- A bench-top linear MALDI-TOFMS is applied to various MS imaging applications in terms of quick and easy operation.
- A rat tissue, a plant seed treated with a pesticide, a fingermark, and a polyester film are analyzed with the instrument successfully.
- An accessible MS imaging work-flow, consisting of a bench-top MALDI-TOFMS, matrix deposition methods, and software, could be applicable to various applications.

2. Introduction

MS imaging is one of the growing applications in mass spectrometry. While the state-of-art instruments, which have high spatial resolution, high MS resolving power capabilities, have been applied to the application, some demands to miniaturization of instrument and high accessibility are increasing in various scientific/industrial fields, in which a high performance of instrument is not necessary. We will report our attempt to apply a bench-top MALDI-TOFMS newly introduced several years ago to the MS imaging application. After evaluating the basic performance of the instrument, a range of samples from food-safety to chemical materials were subject to MS imaging experiments using the bench-top instrument.

3. Methods

Samples

A soy bean seed was sectioned under frozen conditions after treating with a pesticide. A tissue section of rat brain was provided by the Wolfson Molecular Imaging Centre (WMIC) at University of Manchester. A fingermark was collected on a stainless plate directly by impressing a finger on the plate. Commercial food contact film made from polyethylene terephthalate (PET) was prepared with/without high temperature-treatment condition.

Matrix deposition

CHCA was sublimated onto the soy bean seed, while DHB was used for the fingermark and rat brain tissue. Matrices were deposited with a commercial instrument (iMLayer, Shimadzu Corp., Japan). PET films were coated with dithranol solution including NaI by sprayer.

iMLayer

MALDI-TOFMS

All MS analysis and MS imaging at 30 to 50 μm spatial resolution in positive ion mode were performed on the MALDI-8020 bench-top linear MALDI-TOFMS (Shimadzu Corp., Japan) at 200 Hz repetition rate of laser.

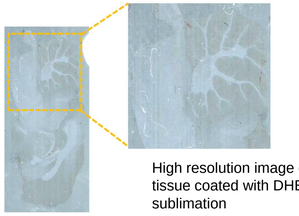
MALDI-8020

Software for visualization

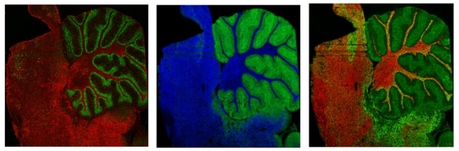
IonView and IMAGEREVEAL (Shimadzu Corp., Japan) were applied to visualize the MS imaging data.

4. Results

4-1. Rat brain at 30 μm spatial resolution



High resolution image of rat brain tissue coated with DHB after sublimation

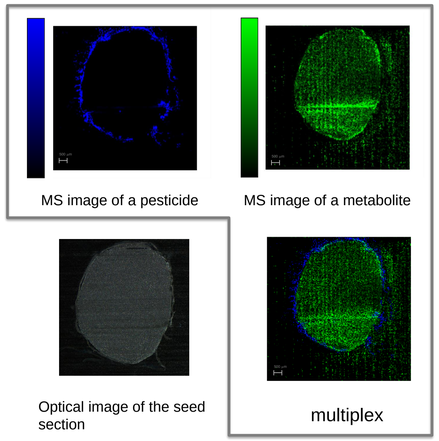


m/z 760; *m/z* 844 *m/z* 772; *m/z* 760 *m/z* 788; *m/z* 734

MS image of rat brain

Fig.1 MS imaging of lipids in rat brain at 30 μm spatial resolution (Data point: 84,681, matrix: DHB sublimated by iMLayer)

4-2. Plant seed at 50 μm spatial resolution

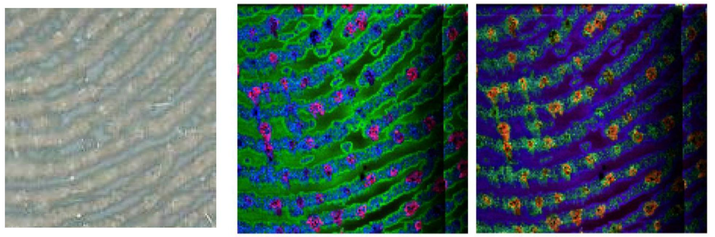


MS image of a pesticide MS image of a metabolite

Optical image of the seed section multiplex

Fig.2 MS imaging of a pesticide in in a plant seed at 50 μm spatial resolution (matrix: CHCA sublimated by iMLayer)

4-3. Fingermark at 30 μm spatial resolution



High resolution image of fingermark coated with DHB after sublimation

m/z 375; *m/z* 549; *m/z* 829 *m/z* 567; *m/z* 829; *m/z* 549

MS image of fingermark

Fig.3 MS imaging of lipids in the fingermark at 30 μm spatial resolution (data point: 23,104, matrix: DHB sublimated by iMLayer)

4-4. Food Contact Material at 50 μm spatial resolution

Small food dish made from PET Heat stress by heater block Cut a circle shape out of the film Fix the circle piece onto stainless plate Matrix coating

Fig.4 Preparation of PET film under various heat stress conditions

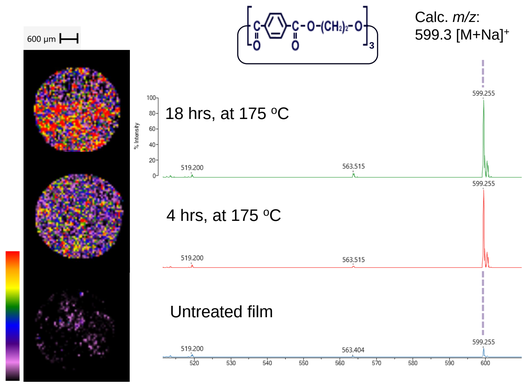


Fig.5 “Mapping” of cyclic trimer of PET in food contact material

5. Conclusions

- The versatility of a bench-top MALDI-TOFMS for a range of MALDI imaging applications has been demonstrated.
- MS imaging at 30 μm spatial resolution was demonstrated in the rat brain and the fingermark data.
- The 50 μm spatial resolution achieved by the instrument allowed to conclude that the pesticide distributed only on the surface of the seed.
- The results of the quick “mapping” of PET oligomer indicated that the work-flow could be useful to evaluate surface of food contact materials and various industrial materials.